

# A PROJECT VIEW OF EMERGENCY RESPONSE

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## **ABSTRACT**

The proper management of emergencies is virtually synonymous amongst practitioners in the field with proper management of response. Emergency response is marked by high saliency, time urgency, and uncertainty. Emergency response has critical attributes in common with project management.

This paper defines the authors' experience in the application of classic project management techniques to response plan evaluation. Through the use of simple computerized project management techniques, a clear picture of the effectiveness of emergency response is possible. The information from this response modeling is quantitative and provides direct guidance in modifying plans.

The authors have applied project management techniques to an analysis of emergency plans around chemical weapon stockpile sites in the continental United States. Of the eight chemical weapon stockpile sites, plans for six have currently been evaluated. The analysis has been found to be a tool of considerable use in identifying areas for further modification.

## **INTRODUCTION**

Innovative Emergency Management, Inc. (IEM), is helping the Chemical Stockpile Emergency Preparedness Program (CSEPP) review emergency plans through an effort termed Systems Analysis. There are eight sites in the continental United States where chemical weapon stockpiles are stored. These weapons are expected to be destroyed over the next few years at onsite chemical destruction facilities. Disposal operations are expected to start in 1995 at the first such facility, at Tooele Army Depot (TEAD).

The CSEP program goal is to mitigate effects of any possible accidents.<sup>1</sup> To support this goal, resources and guidance have been provided to all eight stockpile locations,

including the Army installations, surrounding counties that are included in the defined Emergency Planning Zones (EPZs), and the ten states that are included within the bounds of the EPZs. A major initiative in the program has been the development and evaluation of emergency plans for potential accidents or incidents involving chemical weapons. Emergency plans at each stockpile site generally include Army depot Chemical Accident and Incident Response and Assistance (CAIRA) plans, EPZ county plans, and State(s) plans. These plans form the cohesive system to meet the goal of mitigating effects of an accident.

## **PLANNING FOR EMERGENCY RESPONSE**

The goals of any emergency management can be quickly recounted by the practitioners and the researchers in the field alike: save lives, protect property, minimize disruption. The order of these is significant also. In cases where there is a threat to life, saving lives inarguably is the primary goal of emergency management.

Emergency managers attempt to achieve the goal of saving lives through detailed planning. However, since emergencies happen infrequently and unpredictably, there is limited opportunity for emergency managers to learn from direct, personal experience. There are three major characteristics of emergencies that tend not to be addressed in emergency response plans in general, and in CSEPP plans in particular.

Emergencies are generally associated with a sense of urgency. Decisions need to be made and actions taken within limited time windows. Although there are slowly-developing hazards such as drought, the vast majority of the more common hazards are marked by time pressures. Technological hazards in particular have specific characteristics that have temporal repercussions. Technological hazards are generally associated with rapid speed of onset, no or

little forewarning, and high severity of impact. The net result of these attributes is a need to have the protective actions implemented quickly. If response is not swift enough, planning before the event is virtually useless.

Emergencies demand that responders perform tasks that are highly interrelated. Effective coordination between tasks is essential because the actions in each function involved in emergency response can have a dramatic impact on the performance of other functions. Emergency response is a system. Without a recognition of the high degree of interdependence between parts of the system, one function may be performed in a way that meets its own functional goals very well, yet hurts the performance of other functions that are dependent on it.

Emergencies are characterized by uncertainty. The extent of uncertainty can be higher in technological hazards. With a flood or a hurricane there are predictive factors, some forewarning. With most hazardous materials incidents and other technological hazards, there is considerable uncertainty about what may have occurred already and how it could escalate.

Although planning has been a central activity in emergency management, the relationship between planning and response has been tenuous. The primary product of planning is an emergency plan. There is no direct and mapped process for the use of plans during response. Most plans are written in a format that does not allow quick usage during response. In addition, the plans that the authors have reviewed for the Systems Analysis typically do not account for the time pressure, task interdependency, and uncertainty likely in a response to a chemical stockpile disaster.

### **EMERGENCY RESPONSE MANAGEMENT AND PROJECT MANAGEMENT: A COMPARISON**

Rigorous project management techniques were developed during the World Wars. Gantt charts, PERT charts, and formal operations research were created to meet the needs of large, complex military projects. These techniques have since been widely applied to fields other than defense, such as construction and general management of business projects. Using such tools, businesses have been able to manage large, complex endeavors and ensure that products and services are produced in time and within resource limitations. The requirement for project control using rigorous, quantitative techniques is almost universal in general business and government.

Specific characteristics separate a project from general activities performed by an organization. These attributes of projects are directly comparable to the attributes of emergency response. A comparison of project management and emergency response attributes is shown in Table 1.

Projects and emergency response both have boundaries in time. Emergency response does not have a pre-specified start date. But it does have a specified starting event (an indication or an actual incidence of a hazard). Emergency response also has a specified end event. This is generally defined as the time when the hazard is under control, the people are protected, and recovery efforts can begin.

**Table 1**  
*Comparison of Principal Attributes of Projects and Emergency Response.*

<b>PROJECTS</b>	<b>EMERGENCY RESPONSE</b>
<ul style="list-style-type: none"> <li>• Projects have specific goals. If there is no specified purpose, there is no need to start a project.</li> </ul>	<ul style="list-style-type: none"> <li>• Emergency response has specific, recognized goals.</li> </ul>
<ul style="list-style-type: none"> <li>• Projects have specific start and end time frames, they are not continuous.</li> </ul>	<ul style="list-style-type: none"> <li>• Emergency response has a specific starting event and a specific ending event.</li> </ul>
<ul style="list-style-type: none"> <li>• Projects have defined, limited resources.</li> </ul>	<ul style="list-style-type: none"> <li>• Emergency response is constrained by the resources available when an emergency occurs.</li> </ul>
<ul style="list-style-type: none"> <li>• Projects consist of a series of interdependent tasks which must be performed in a certain order.</li> </ul>	<ul style="list-style-type: none"> <li>• Emergency response involves highly interrelated tasks in which effective coordination is critical.</li> </ul>
<ul style="list-style-type: none"> <li>• Projects have specific milestones or time frames when certain objectives must be achieved to ensure that the final goals are met.</li> </ul>	<ul style="list-style-type: none"> <li>• Intervention to provide emergency response assistance must be sensitive to the tempo of the event.</li> </ul>

Projects and emergency response are both constrained by limited resources. Project resources include people, things and information. The supply of these resources is limited and rather inflexible to demand. Most projects cannot arbitrarily increase the number of people available if milestones are not being met. The situation in

emergency response is analogous. If an event occurs during off-duty hours, the supply of personnel and resources available to assist early response will be severely constrained in most communities. An event occurring during regular business hours will benefit from greater resource availability.

Projects and emergency response both consist of a series of interdependent tasks. Project management techniques break a project down into a set of steps leading from, say, a set of architect's drawings to a completed building. The project schedule is defined by outlining the relationship between project steps, such as the need for the building frame to be erected before electrical wiring begins. Similarly, emergency response tasks form a chain of events leading from, for example, detection of a hazard to protection of populations at risk. The tasks in emergency response are typically linked by the information which must be passed between them.

Projects and emergency response are both carried out in highly time-sensitive environments. Emergency response support must be provided in time to affect the course of events and attendant consequences. The right action taken too late will not only be late but may be totally ineffective in reaching goals. Delay in performing tasks can doom a project to a delayed completion. Delay in performing critical emergency tasks does not just make the response late; it makes it superfluous.

Quantitative project management is based on the attributes of projects. Project management techniques empower managers to:

- Identify the tasks that need to be completed to meet project goals.
- Identify the relationship between tasks. This relationship defines task precedence.
- Determine if the project can be completed in time within the stated constraints of resources and scope of defined work.
- Discretely measure the time necessary for completion of specified milestones based on the duration of activities.
- Determine the cost of the project based on use of projected resources.
- Vary project attributes to determine the resultant effect on cost and schedule.
- Measure planned progress against actual performance and use this information to determine if the project will achieve identified targets.

All these attributes are critical to emergency response. The central paradigm of quantitative project management is the breakdown of goals into discrete tasks and

the management of time and cost through planning and tracking. This paradigm is wholly applicable to emergency response, with the additional caveat that emergency response must evaluate plans not against actual performance but expected performance. We cannot wait for an emergency to deduce if emergency plans will work. The evaluation of emergency plans must be based on walkthroughs, exercises, and drills.

### RESPONSE PLANNING EVALUATION USING PROJECT MANAGEMENT TECHNIQUES

It is impossible to control what you cannot measure. To control emergency response, it is important to determine when response plans will not achieve their primary goal of saving lives. A plan evaluation must be detailed and quantitative to provide explicit guidance on how much improvement is needed and whether changes being made are leading to improvements in the right direction. Such continuous improvement through measurement and modification is the foundation of the Total Quality Movement (TQM) and Statistical Process Quality Control (SPQC) movements. Both TQM and SPQC have led to substantial gains in the improvement of manufacturing and service processes. The rise of Japan as an industrial competitor has been linked to these techniques. Progressive companies and government agencies in the United States are attempting to integrate TQM and SPQC into their operations. The Malcolm Baldrige Quality Award is based on the same notion of process control through measurement and evaluation.

For the Systems Analysis project, IEM has developed techniques to apply detailed measurement to emergency response planning using computerized project management tools. Plans for each CSEPP site were analyzed and converted into an integrated project chart. Principal actions that support saving lives were mapped for all major emergency response elements: Army stockpile installations, EPZ counties, and states. IEM also included in each model the actions presumed to be taken by the responding population.<sup>2</sup> IEM and site personnel worked together to estimate task durations and establish task precedences. Protective action time estimates for the chosen protective action strategy (evacuation or sheltering) were modeled as part of the response model. A clear, quantitative picture of the response system at a site emerges through such response modeling.

This response model was compared to the time expected to be available during response. Using simulation models to map atmospheric dispersion of chemical agent vapors, a time of arrival of the hazard was derived. The

response model was compared to the time of arrival of hazard. Clearly, the goal of saving lives is not met if people at risk are not protected when the hazard arrives at their location.

The use of project management techniques addresses the characteristics of emergencies that are too easy to neglect in response planning. Project management tools are designed to highlight the time pressures, task dependencies, and resource constraints that are common to projects and emergency response. Although project management does not concern itself particularly with the problem of uncertainty, a well-defined response schedule does indicate areas where tasks need to be done before concrete information is available.

A Systems Analysis has been performed for six of the eight chemical stockpile sites. These visits have demonstrated the validity and value of this evaluation technique. It has been cited by a number of the sites as providing guidance for plan modifications.

## **CONCLUSIONS**

The response modeling for the six chemical stockpile sites has indicated that this technique is extremely beneficial. Emergency managers' response to the Systems Analysis has been overwhelmingly positive. The technique has a number of clear advantages. Firstly, emergency managers are able to get a clear, coherent picture of the sequence of actions for the complete response system. This leads to a better understanding of the needs and constraints of other jurisdictions and agencies involved in emergency response. Such understanding can form the basis for greater coordination and integration of response. Secondly, it is clear from participant comments that the Systems Analysis allows a distinction between desired efficacy of response and modeled efficacy of response. Many managers stated that tasks needed to be completed within five minutes of the event occurring. The Systems Analysis made apparent that these tasks, as presently constituted, could not be completed in the desired time frame. To meet the desired time frames, the nature of tasks performed, their relationships, and resources may need to change. Thirdly, since the hazard arrival time can be integrated into the model, the hazard and the intended response are both defined in the same terms, in terms of time. Finally and most importantly, the technique provides a clear evaluation of the extent to which emergency response plans can be expected to meet protection goals under different hazard conditions.

<sup>1</sup>CSEPP Policy Paper No. 1

<sup>2</sup>This element is often neglected in emergency planning. Populations-at-risk are presumed to respond as directed by the emergency managers. However, researchers have repeatedly found in empirical studies that a complex pattern of decision making and action exists at the individual and social levels during emergencies.